

NATIONAL RADIUM INSTITUTE
500 S. Santa Fe Drive
Denver
Denver County
Colorado

HAER NO. CO-42

HAER
COLO,
16-DENV,
52-

PHOTOGRAPHS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Rocky Mountain Regional Office
P. O. Box 25287
Denver, Colorado 80225-0287

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HISTORIC AMERICAN ENGINEERING RECORD
NATIONAL RADIUM INSTITUTE, DENVER, COLORADO

I. INTRODUCTION

Location: 500 S. Santa Fe Drive, Denver, Colorado
(Also known as 457 S. Elati Street during the
period of operation).

Date of

Construction: Old or "First" plant completed in March 1914.
New or "Second" Plant completed in February 1915.
The only buildings remaining on the site today from the
early 1900s are the Sulphate or "Lab" Building,
constructed in 1914 or 1915, and the "Office" Building,
date of construction unknown but prior to 1929.

Present Owner: Robinson Brick Company
P.O. Box 5243
1845 West Dartmouth
Denver, Colorado 80217

Present Use: The two remaining National Radium Institute buildings
will be demolished in the spring of 1988 due to
extensive radiological contamination.

Significance: The National Radium Institute was incorporated in
September 1913 to extract radium from domestic ores for
use in cancer treatment and other technical studies, and in

the process, to develop cost-effective methods of radium extraction. The National Radium Institute signed a cooperative agreement with the U.S. Bureau of Mines in October 1913 under which the Bureau provided technical expertise and the Institute provided funding to purchase ores and to construct and operate a radium processing plant in Denver. The Denver plant was closed in 1917 after producing 8.5 grams of radium.

Historian: Susan M. Rush, UNC Geotech, January 1988

II. HISTORY

A. Establishment of the National Radium Institute

The discovery of the x-ray-emitting properties of uranium compounds by Henri Becquerel in the late 1800s and the subsequent discovery in 1898 and isolation in 1902 of radium by Pierre and Marie Curie led to a demand for radium salts among medical researchers experimenting with the use of radium to treat cancer. Carnotite and pitchblende ores from Colorado were shipped to Europe for extraction of radium salts. By 1912, Charles L. Parsons, U.S. Bureau of Mines, brought attention to the rising concern among scientists in the United States that radium-bearing ores from the U.S. were being sold at relatively low prices to European radium processors who, in turn, sold the refined radium salts back to researchers in the U.S. at a premium¹. With the threat of war in Europe, U.S. scientists became even more concerned with the need for the development of domestic radium processing operations.

The National Radium Institute (NRI) was formed as a result of these concerns. The NRI was incorporated in the states of Delaware and Colorado in September 1913, with a total authorized capital stock of \$150,000. The key directors of the NRI were James A. Douglas, Phelps Dodge and Company, New York, and Howard A. Kelley, Johns Hopkins University, Baltimore. Drs. Douglas and Kelley had approached the U.S. Bureau of Mines with a proposal to form an organization devoted to to the mining, concentration, and manufacture of radium, uranium, and vanadium from carnotite, pitchblende, and other radium ores. The NRI signed a cooperative agreement with the U.S. Bureau of Mines in October 1913. The terms of this agreement included the provision of technical support for the study of ore treatments and the supervision of the actual mining and processing operations by the Bureau of Mines, while the NRI provided capital for such operations². The first seven grams of radium produced were to be divided between the two hospitals represented by Drs. Douglas and Kelley for use in cancer treatment studies. Any radium produced by the NRI in excess of seven grams was to be donated to the Bureau of Mines for experimental purposes.

B. Construction Chronology

The National Radium Institute experimental plant was constructed in Denver in 1914. The old or "first" plant was completed in March of that year and experimental work began immediately. After the operational success of this plant had been demonstrated, the NRI began construction of the new or "second" plant. This second plant, which was completed in February 1915, permitted more rapid processing of radium. A boiler and compressor plant was

built at the same time as the new or "second" plant in order to service both processing plants.

A separate building referred to as the sulphate building was constructed sometime prior to September 1915, probably contemporaneously with the old or "first" plant. This building was used for the refining of radium concentrate from the two plants. A nitric acid plant was constructed in December 1914 and January 1915 for the production of nitric acid from recovered sodium nitrate. A small concrete building was erected sometime prior to September 1915, which provided storage space for the recovered sodium nitrate.

This construction chronology was taken from the U.S. Bureau of Mines Bulletin 104, which contains plans and photographs of these buildings as they existed circa 1915 (see field records). None of the records examined contain any reference to construction of the "office" building.

C. Industrial Process

Although several methods of treating radium ores had been developed prior to the opening of the National Radium Institute, Bureau of Mines personnel at the NRI devised new techniques for the extraction of radium from carnotite ore and for the conversion of the sulfates to chlorides. The plant utilized a nitric acid leach process for treating carnotite ores. This method is described in detail in the U.S. Bureau of Mines Bulletin 104. The Bureau of

Mines cited recoveries of over 90 percent using this direct dissolution technique. At the time the NRI plant closed, 8.5 grams of radium had been extracted at an average cost of \$38,000 per gram.

D. Dissolution of the National Radium Institute and Subsequent Site History

The National Radium Institute plant in Denver was closed down by April 1, 1917. The NRI was officially dissolved in Delaware in late 1919 and in Colorado on January 20, 1920.

The plant was purchased by the Minerals Recovery Company in 1919. The company signed a contract for the production of 10 grams of radium in 1919³. The Minerals Recovery Company sold the plant and equipment under contract in 1924 and went out of business in March 1925.

The site changed hands several times between 1925 and 1941, when the Robinson Brick and Tile Company started operations there. By 1956, a grinding plant had been erected over ground formerly occupied by the National Radium Institute's new or "second" plant (see field records - figure 2). Only the sulphate or "lab" and office buildings remain standing from the days of radium processing on the site.

III. THE SULPHATE OR "LAB" BUILDING AND THE "OFFICE" BUILDING

A. Description

The sulphate or "lab" building was built as a facility for the preliminary treatment and fractionation of radium barium sulphates produced by the "first" and "second" plants. This metal-clad, frame-construction building also housed a small laboratory and office, as well as a small reinforced concrete storeroom (see field records).

The "office" building is also of frame construction. No information could be located on the date the building was erected or on its function (see field records). It apparently did not exist at the time the U.S. Bureau of Mines published Bulletin 104 (see field records).

B. Modifications

Both buildings have been extensively modified since the time of construction. The sulphate or "lab" building was remodeled by the Robinson Brick Company to house their own laboratory. The "office" building was used by the Robinson Brick Company as an office. The exterior walls were partially tiled to display the company's products.

These two buildings are currently standing unused, in an extreme state of disrepair (see photographs 1 through 8). Both are radiologically contaminated.

C. Ownership and Future

The sulphate or "lab" and "office" buildings are owned by the Robinson Brick Company. This property was placed on the National Priorities List by the U.S. Environmental Protection Agency in 1981 for cleanup under Superfund.

Due to the extensive interior radiological contamination in these two buildings, both are slated for demolition as part of remedial action on the property.

IV. BIOGRAPHICAL MATERIAL

A. National Radium Institute

The directors of the NRI were Dr. James A. Douglas, Phelps Dodge and Company, New York; Dr. Howard A. Kelley, Johns Hopkins University, Baltimore; Dr. C. F. Burnam, associate of Dr. Kelley; Mr. Archibald Douglas, nephew of James Douglas; and Mr. E. J. Maloney, of Wilmington, Delaware¹. Dr. James Douglas was a mining industrialist and philanthropist who had an association with General Memorial Hospital in New York City. Dr. Kelley was a gynecologist and cancer specialist who operated a private hospital in Baltimore and was a member of the faculty of Johns Hopkins University Medical School⁴.

B. U.S. Bureau of Mines

Key Bureau of Mines personnel associated with the National Radium Institute included Charles L. Parsons, Chief of the Division of Mineral Technology; R. B. Moore, Director of the Denver Office of the Bureau of Mines and physical chemist; K. L. Kithel, mineral technologist; O. C. Shaeffer, plant superintendent; and S. C. Lind, chemist in radioactivity.

V. FOOTNOTES

1. Parsons, C. L. "The Western Metallurgical Field - National Radium Institute," Metallurgical and Chemical Engineering, Vol. XI, No. 12, December 1913, p. 674.
2. Parsons, Charles L., R. B. Moore, S. C. Lind, and O. C. Schaefer, Extraction and Recovery of Radium, Uranium, and Vanadium from Carnotite, U.S. Bureau of Mines Bulletin 104, Washington, D.C., Government Printing Office, 1915, p. 9.
3. Denver News, 6 February 1919.
4. Landa, Edward R., "The First Nuclear Industry," Scientific American, November 1982.

VI. BIBLIOGRAPHY

A. Books

Bruyn, Kathleen, Uranium Country, Boulder, Colorado, University of Colorado Press, 1955.

Kithel, Karl L., and John A. Davies, Mining and Concentration of Carnotite Ores, U.S. Department of Interior Bureau of Mines, Bulletin 103, Washington, O.C., Government Printing Office, 1917.

Manning, Van H., Experiment Stations of the Bureau of Mines, U.S. Department of Interior Bureau of Mines, Bulletin 175, Washington, D.C., Government Printing Office, 1919.

Moore, Richard B., and Karl L. Kithel, A Preliminary Report on Uranium, Radium, and Vanadium, U.S. Department of Interior Bureau of Mines, Bulletin 70, Washington, D.C., Government Printing Office, 1916.

Parsons, Charles L., R. B. Moore, S. C. Lind, and O. C. Schaefer, Extraction and Recovery of Radium, Uranium, and Vanadium from Carnotite, U.S. Department of Interior Bureau of Mines, Bulletin 104, Washington, O.C., Government Printing Office, 1915.

B. Periodicals

Hart, Stephen S., "The Denver Radium Boom and the Colorado School of Mines, Golden," The Mines Magazine, February 1986.

Landa, Edward R., "The First Nuclear Industry," Scientific American, November 1982.

Parsons, Charles L., "The Western Metallurgical Field - National Radium Institute," Metallurgical and Chemical Engineering, Vol. XI, No. 12, December 1913.

C. Newspapers

Denver News, 24 October 1913
_____, 28 January 1915
_____, 30 January 1915
_____, 14 February 1915
_____, 31 March 1915
_____, 6 February 1919

Denver Post, 9 February 1915

Denver Times, 11 January 1913
_____, 12 June 1913
_____, 1 November 1913
_____, 9 February 1915

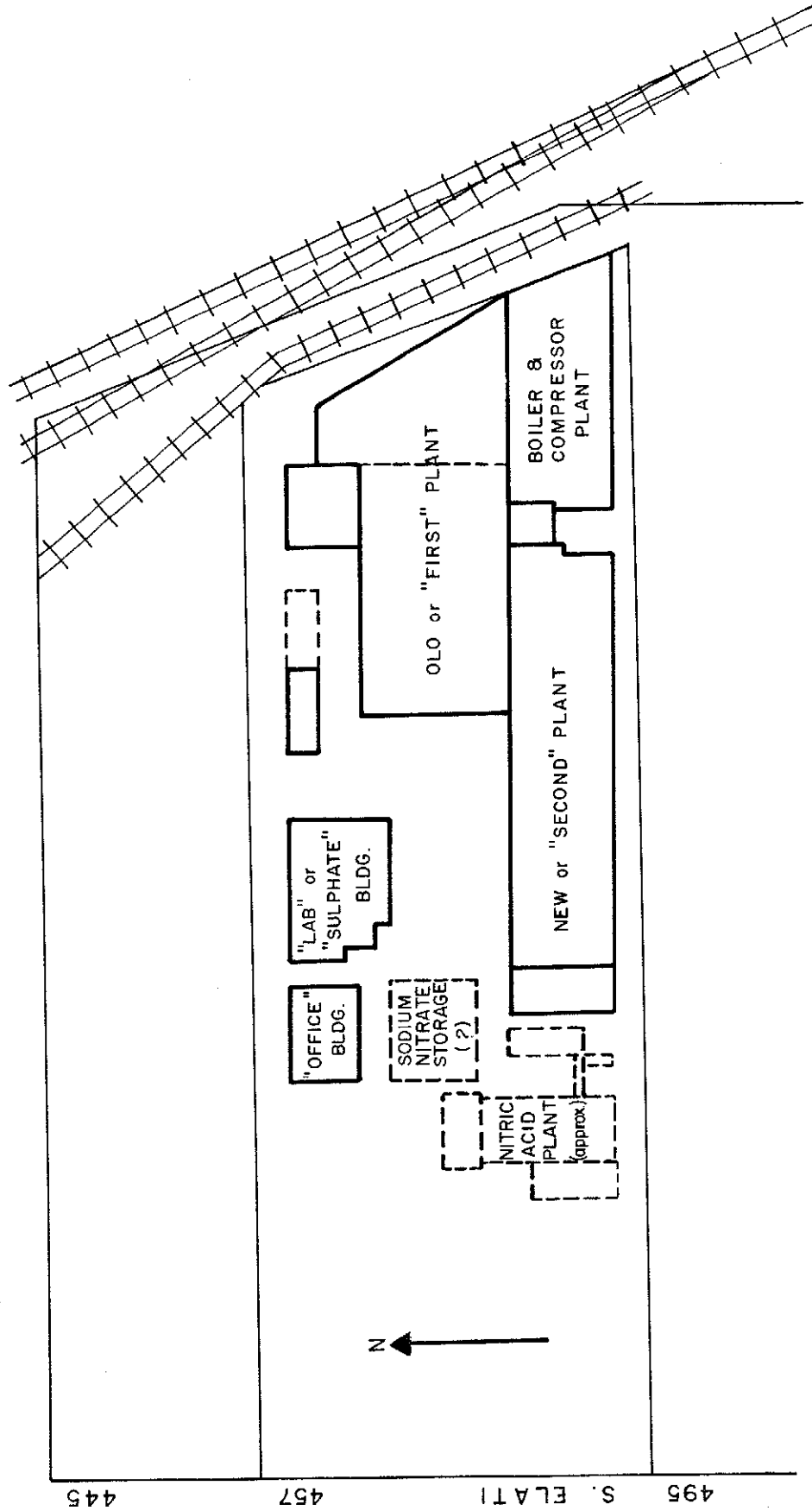


Figure 1. Sketch Map of the National Radium Institute as it existed circa 1915. Scale: 1 inch equals approximately 50 feet. Solid lines from Sanborn Map Co., Denver, Colorado, 1929. Dotted lines estimated from plans and photos contained in U.S. Bureau of Mines Bulletin 104, 1915. Date of sketch: December 1987.

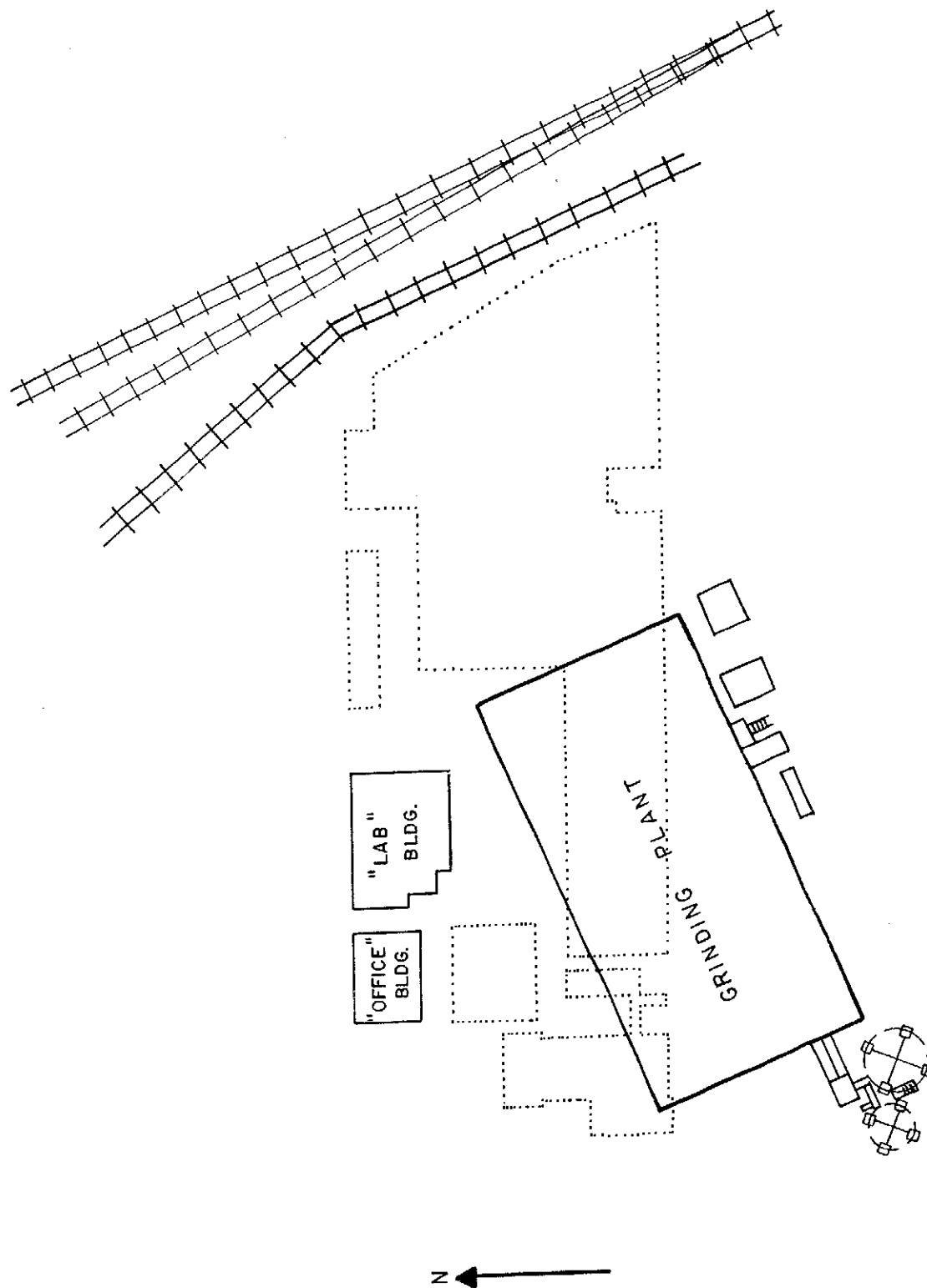


Figure 2. Sketch Map of the former National Radium Institute site. Dotted lines indicate locations of NRI buildings no longer in existence. Scale: 1 inch equals approximately 50 feet. Date of sketch: December 1987.

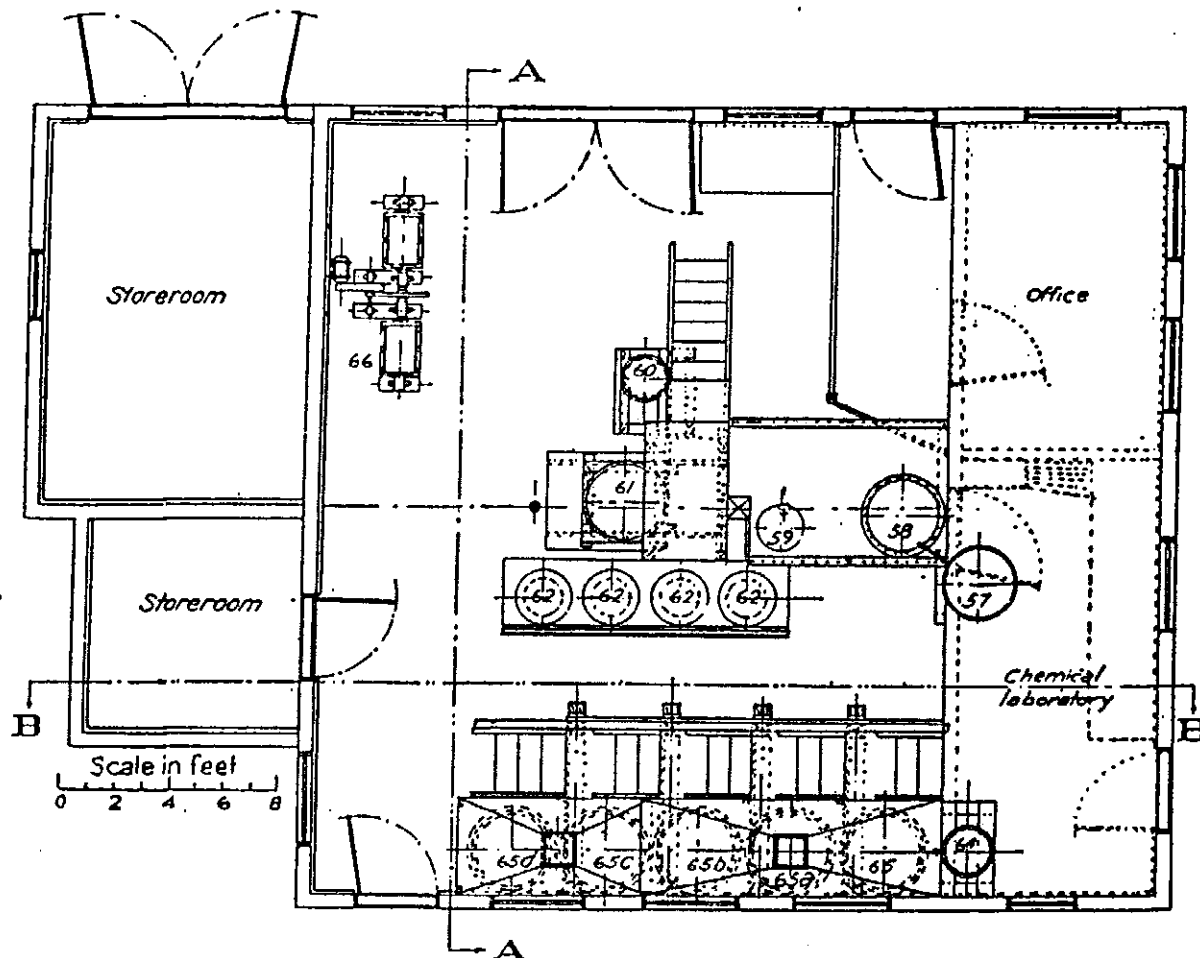


FIGURE 2.—Plan of sulphate building. 57, condenser; 58, distilled-water reservoir; 59, baffle; 60, experimental pressure apparatus; 61, earthenware suction filter; 62, silica-lined fractionating pot; 63, dissolving pot; 64, suction filter; 65, 65a, etc., steam-jacketed fractionating vessels; 66, ball mills.

Source: Parsons, Charles L., R. B. Moore, S. C. Lind, and O. C. Schaefer, Extraction and Recovery of Radium, Uranium, and Vanadium from Carnotite, U.S. Department of Interior Bureau of Mines, Bulletin 104, Washington, D.C., Government Printing Office, 1915.